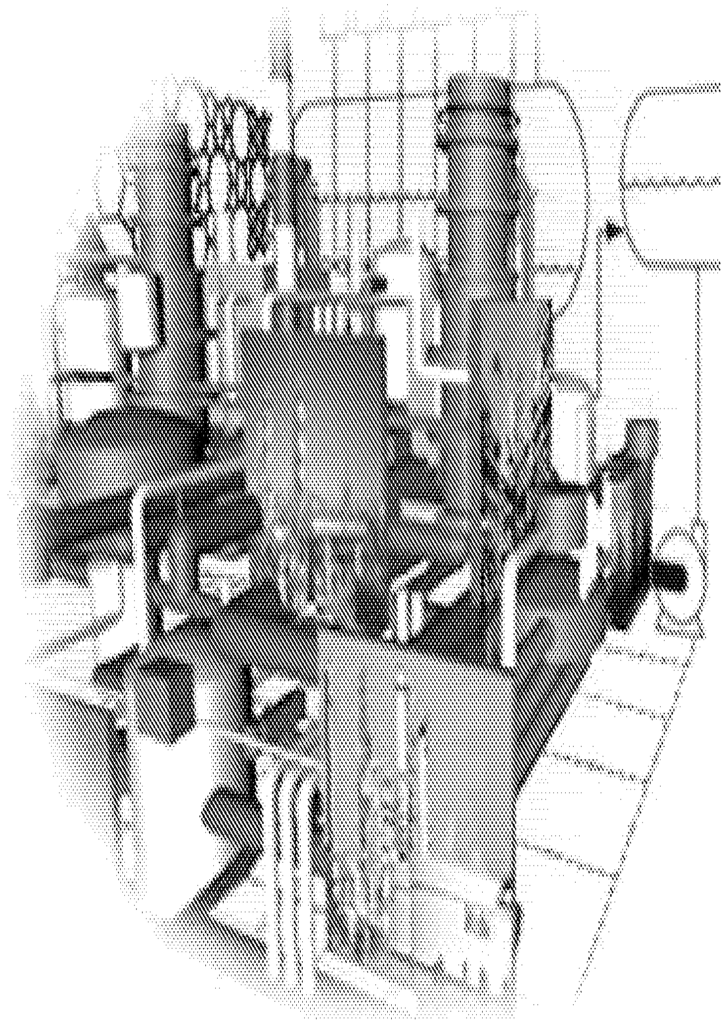
Delivering Value for Resid and Heavy Feed

1st Russia & CIS
Bottom of the Barrel
Technology Conference
Moscow
April 19, 2005



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Outline

- Installed Capacity & Technology Selection
- FLUID COKING™ and FLEXICOKING™
- Economic Comparison of Options

Growing Interest in Resid Conversion - Why Now?

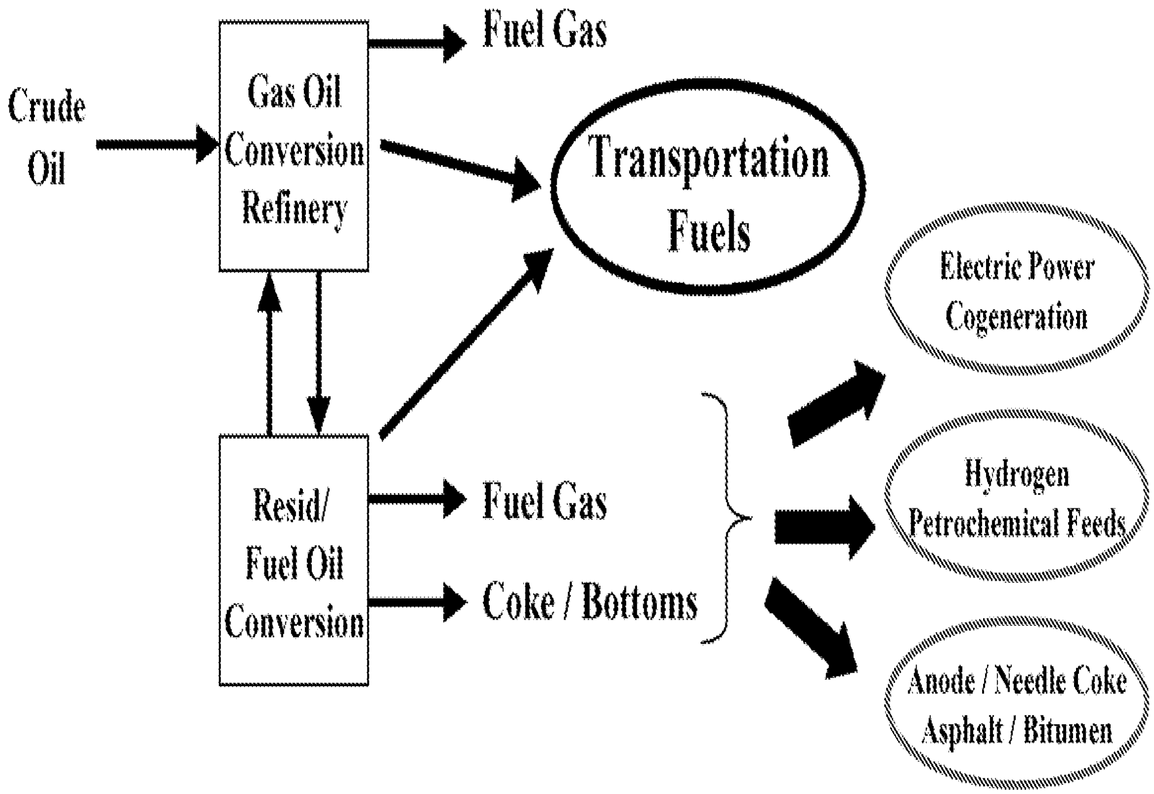
Driver		Refiners' Response
Rising Crude Cost	→	•Produce More Clean Products per Crude Barrel •Process Lower Cost Heavier Crudes •Increase Production of Heavy Crude Resources
Declining Fuel Oil Demand	→	• Implement High Return Conversion Projects • Move to Bottomless / Fuel Oil Free Refinery
Higher Natural Gas Price	→	• Optimize Refinery Fuel Usage • Employ Technologies that use Lower Cost Fuels • Find Lower Cost Energy Sources for Oil Recovery

Refiners Today Consider Broader / More Flexible Approaches

Production of Clean Transportation Fuels is Important.......

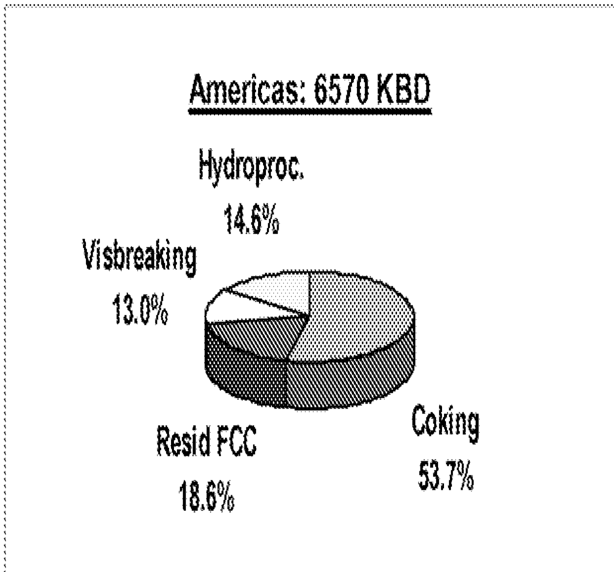
....But Also Want the Flexibility to Capture New Opportunities

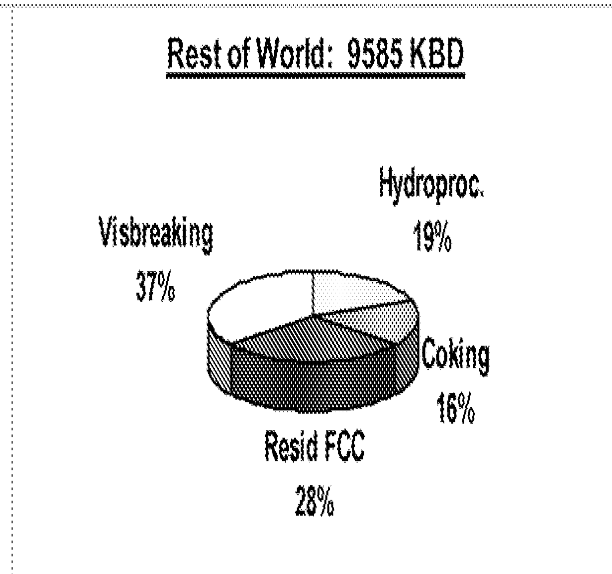
- Process Lower Cost / Poorer Quality Crudes / Resids
- New Markets
- Staged Investments



Resid Processing Capacity: Type and Trend

- Americas have >40% of World Wide Installed Resid Conversion Capacity
  - Coking the Predominant Processing Choice
- Visbreaking Widely Used in Rest of World

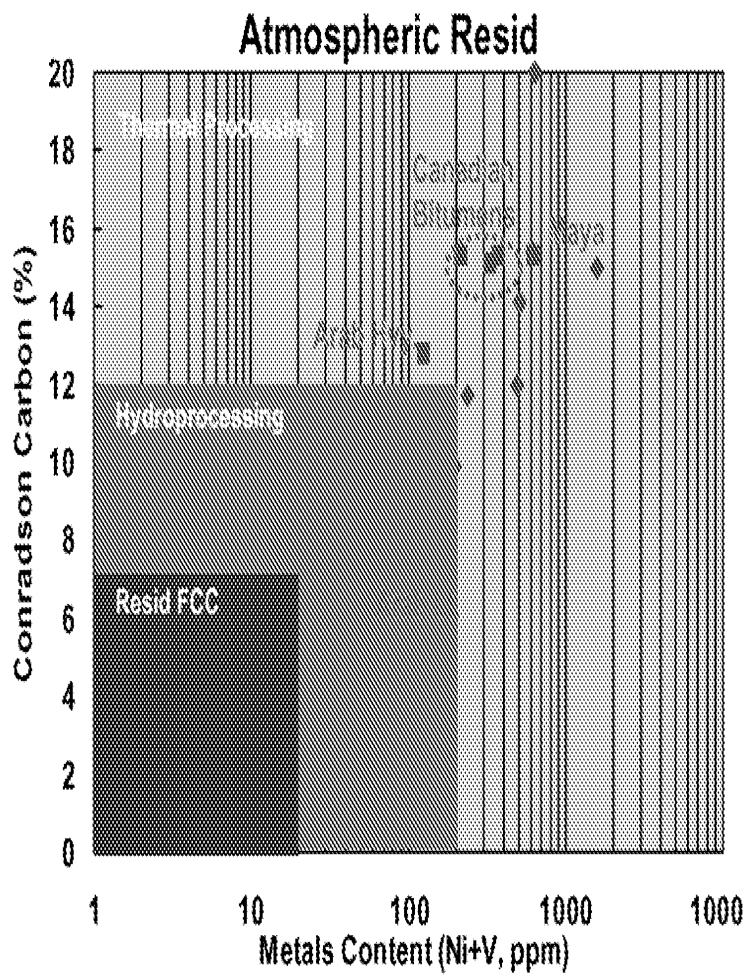




- Hydroprocessing in Areas with Fuel Oil Outlets and Suitable Crudes
  - Capacity increased ~200 kbd from 1999 - 2003
- Coking Capacity increase ~1000 kbd from 1999 - 2003
  - Approximately 25% in Upstream Projects (e.g. Canada , Venezuela)
- ExxonMobil operates ~860 KBD of Resid Capacity; ~60% is Coking

Resid Quality Drives Refinery Conversion Options

- Resid FCC OK with Good Resids
  - Metals deactivation and coke burning capability are constraints
- Hydroconversion Can Be Used with Moderate Quality Resids
  - Moving bed or onstream replacement used to mitigate catalyst deactivation
  - Limited to moderate conversion by product incompatibility
  - Bottoms disposal an issue
- Thermal Conversion Best with Poor Feeds
  - Reject Carbon and Metals to Coke
  - Delayed Coking
  - FLUID COKING, FLEXICOKING



FLUID COKING / FLEXICOKING / Delayed Coking Comparison

FLUID COKING / FLEXICOKING

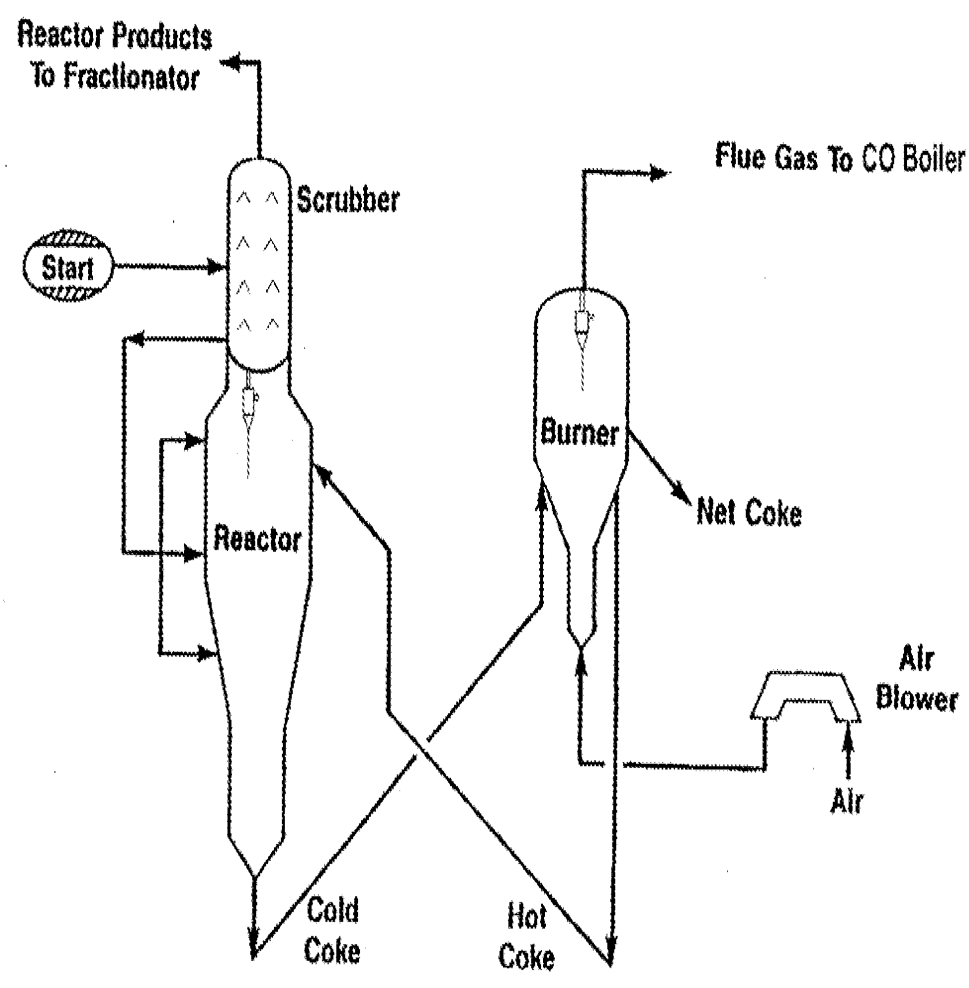
- **Liquid Product Yields Slightly Higher Than in Delayed Coking**
- **Continuous Process**
  - Steady state operations
  - Staffing requirements low
- **Handles Virtually Any Pumpable Hydrocarbon Feed**
- **Coke Has Multiple Roles**
  - Heat transfer medium
  - Low value coke supplies process heat
- **Utilities**
  - Little or no fuel gas use
  - High net steam generation
- **Environmental**
  - FLK offgas scrubbed to meet sulfur emissions limit
  - FXK coke gas desulfurized to make low sulfur clean fuel for refinery use

Delayed Coking

- **Liquid Product Quality Slightly Better Than Fluid Bed Coking**
- **Cyclic Process**
  - Short drum cycles (12-18 hours)
  - Temperature cycles / Drum stressing
  - Staffing requirements high
- **High CCR Feeds Can Coke Furnace**
  - More frequent spalling/decoking
  - Feed "dilution", derating thruput
- **Coke Is Only a Reaction Product**
  - Produce more coke than FLUID COKING
- **Utilities**
  - Furnaces use large amount of fuel gas
  - Almost zero net steam generation
- **Environmental**
  - Open coke piles becoming problematic
  - Require low sulfur fuel gas to meet sulfur emission limits

FLUID COKING Process

- Continuous Fluid Bed Processes
- Developed Based on ExxonMobil Fluid Catalytic Cracking technology



Operating Principles of FLUID COKING

- Hot Resid Sprayed into Fluidized Coke Bed
  - Coking reactions occur in thin film on outside of coke particles
  - Small particles provide surface area for reaction
  - Coke bed fluidized by product vapors & steam at bottom of reactor
- Product Vapors Flow Overhead Through Cyclones to Scrubber
  - Cyclones remove bulk of coke particles
  - Scrubber condenses heavy liquids / recycles into reactor, removes entrained coke dust.
  - Coke free hydrocarbon products leave scrubber overhead to product fractionator
- Heat for Reaction Supplied by Partially Combusting Coke in Burner
  - Hot coke particles flow in transfer line from burner to reactor
  - Cold coke particles flow from reactor to burner

FLUID COKING Unit

- Located in California
- Started up in 1969
- Currently 28 KB/SD
- Burner in Foreground
- Scrubber Above Reactor

FLUID COKING: Coke Utilization

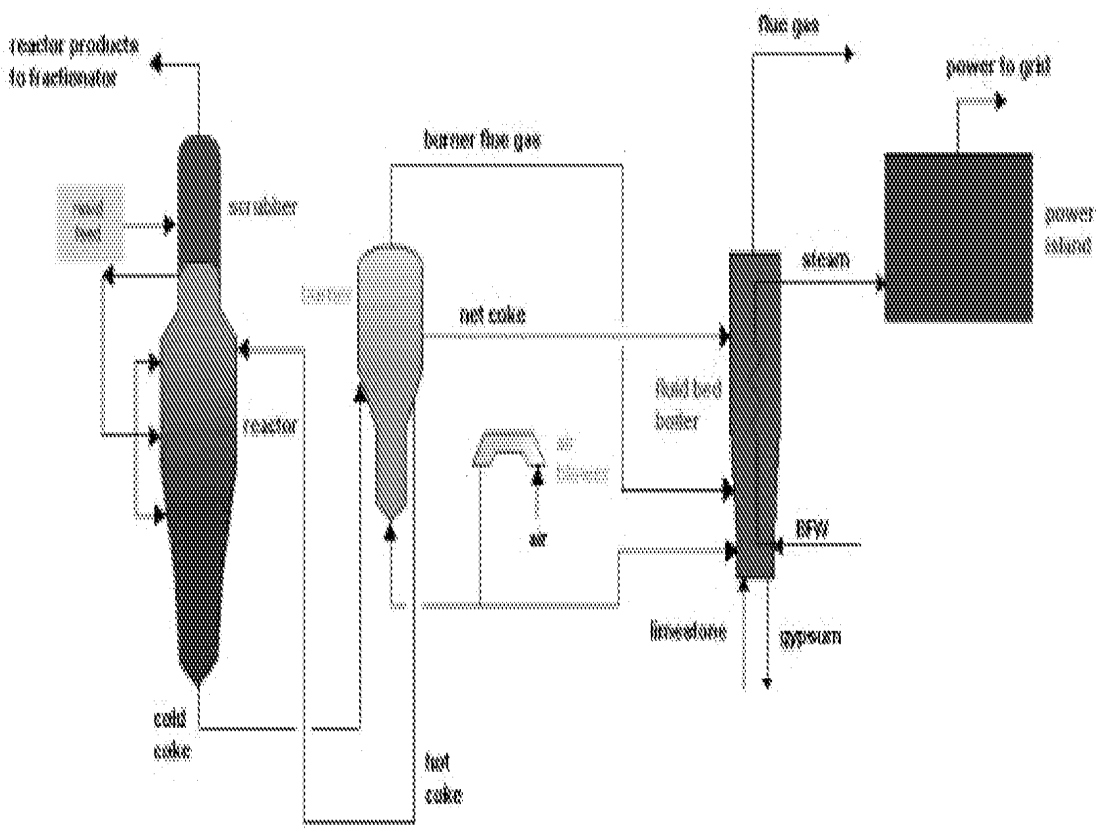
- About 20% of Coke Produced is Burned to Supply Process Heat

- Fluid Coke Typically Sold in the Solid Fuels Market
  - About half is sold as fuel to cement industry
  - Also a large % is burned in boilers and power plants

- Fluid Coke Used Directly in Commercial Fluid Bed Boilers to Produce Electricity/steam
  - Grinding not required due to small, uniform coke particle size
  - SO_x and NO_x emissions controlled with limestone & ammonia addition
  - Five sites in California generate ~100 MW
  - ExxonMobil a partner in ~ 60 MW co-generation project in Montana

FLUID COKING With Integrated Fluid Bed Boiler for Efficient Power Production

- FLK Coke Burned in Circulating Fluid Bed Boiler (CFFB) Produces High Pressure Steam to Drive Turbines to Produce Power
- FLK Burner Overhead and CFBB Flue Gas Streams Cleaned Together
- CFBB Can be Located either “On Site” or “Outside Refinery Fence”



FLUID COKING Commercial Experience

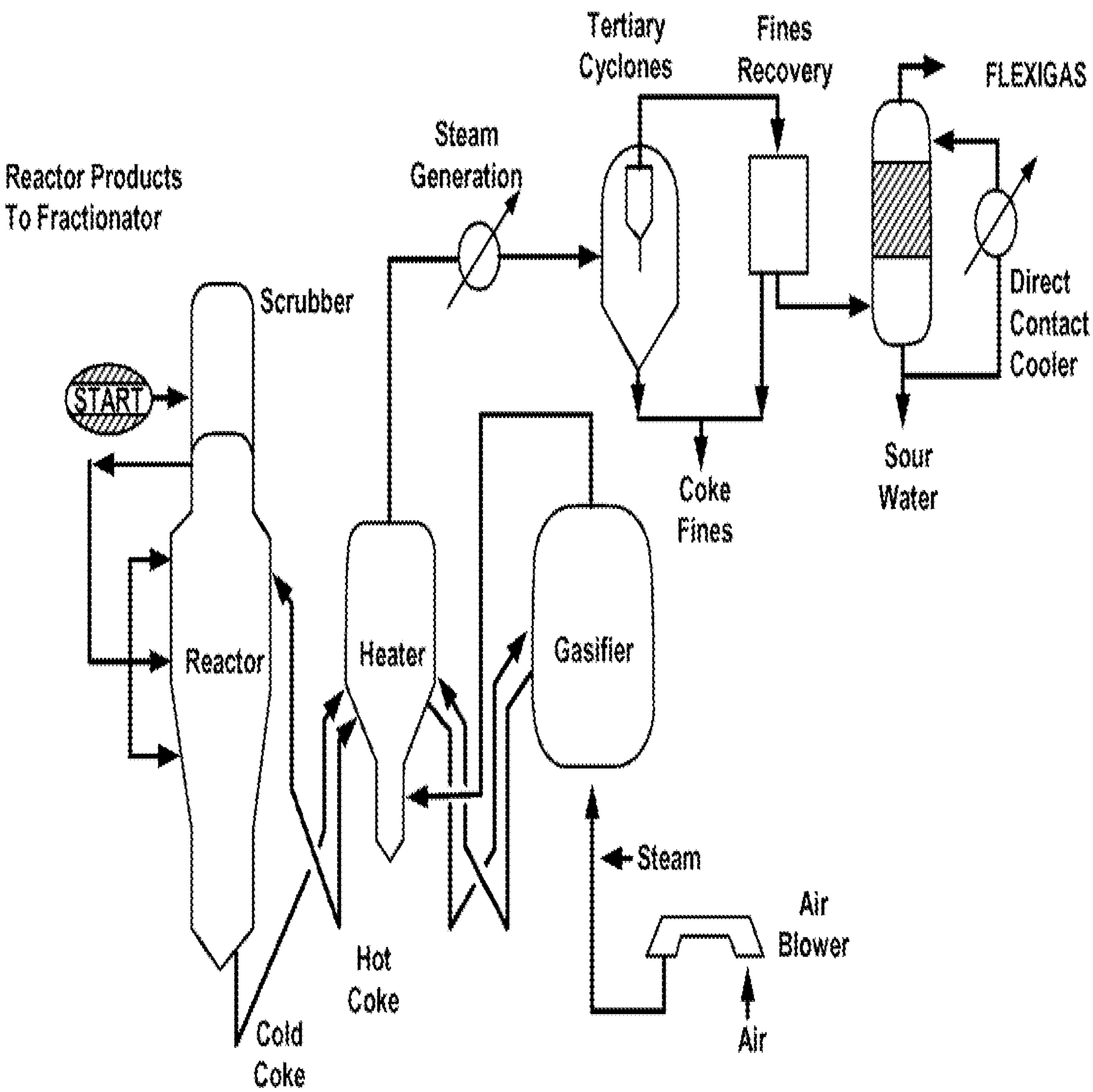
- First Commercial Application 50 Years Ago
- Over 330 Years of Cumulative Operating Experience; Significant Improvements in Capacity
- Currently 7 Units Process >365 kb/d; ExxonMobil Owns & Operates Two Units
- Largest Designed Unit Currently Under Construction in Canada

Company	Location	Initial / Current Feed Rate, kb/d
ExxonMobil	Montana	4 / 9
Tesoro	California	42 / 42
Premcor	Delaware	42 / 52
Imperial Oil	Canada	14 / 21
Valero	California	16 / 28
Syncrude	Canada	73 / 108
Syncrude	Canada	73 / 108
Syncrude	Canada	95*

* = under construction

FLEXICOKING Process

- Fluid Bed Coking With Integrated Air & Steam Gasification of Coke
- Produces Clean CO/ H_2 Rich Refinery Fuel Gas



Operating Principles of FLEXICOKING

- Reactor Design / Operation Similar to FLUID COKING
- Steam Gasification of Coke produces a Clean Fuel Gas (FLEXIGAS) from Lowest Value Stream in Refinery
- Process Heat Requirements are Supplied by Combustion of Coke with Air, Eliminating Need for External Fuel Supply
- Approximately 99% of the Products are Liquids and Gases
- Feed Metals Concentrated in Coke Fines Products
  - Markets: solid fuel, metallurgical applications, metals reclaiming
- Low Pressure Design Permits the Use of Standard Refractory Lined Carbon Steel Construction for Major Process Vessels

FLEXICOKING: FLEXIGAS Utilization

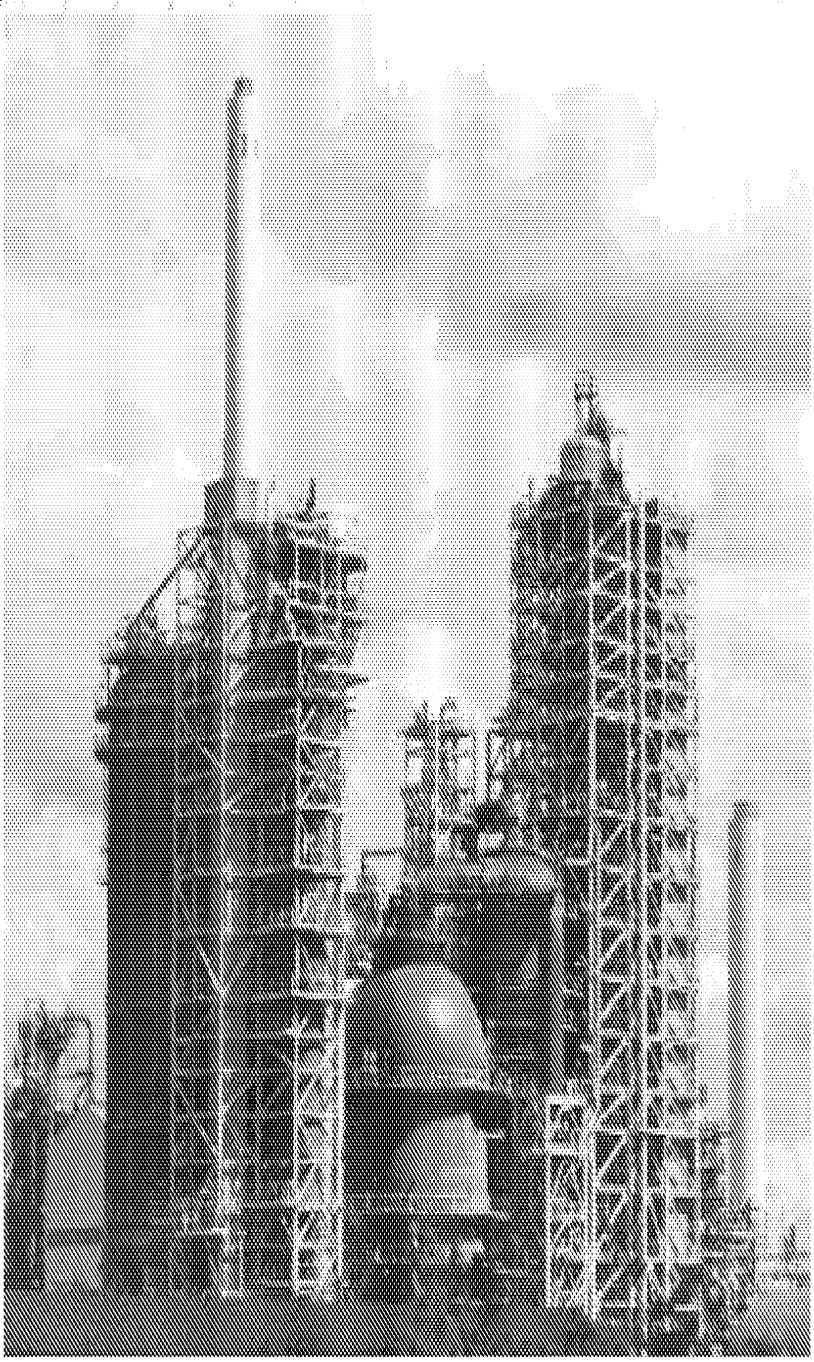
- FLEXSORB® Gas Treating Technology Reduces Sulfur Content to Very Low Levels (< 10 vppm H_2S)

- FLEXIGAS is Rich in CO and H_2, Heating Value Reduced by Nitrogen Diluent in Combustion Air

- FLEXIGAS Burns Very Readily in a Number of Services in a Variety of Commercially Available Burners
  - Process heaters (pipestills, naphtha reformers, hydrogen plant steam reformers, etc)
  - Utilities (steam generation, steam superheaters, gas turbine waste heat boilers)
  - Over-the-fence sales

- Distribution System Costs are Low

FLEXICOKING Unit



- Location: Rotterdam
- Started up in 1986
- Currently 40 KB/D
- Gasifier in Center (green)
- Coke Silos on Left
- Heater and Reactor / Scrubber on Right

Commercial FLEXICOKING UNITS

- FLEXICOKING First Commercialized Over 20 Years Ago
- Currently 5 Units Operating With a Total Capacity of >190 kB/D
- ExxonMobil Owns and Operates Two FLEXICOKING Units

Company	Location	Initial / Current Feed Rate, kB/D
Showa-Shell	Japan	21 / 24
PdVSA	Venezuela	52 / 65
Shell	California	22 / 22
ExxonMobil	Netherlands	32 / 40
ExxonMobil	Texas	33 / 42

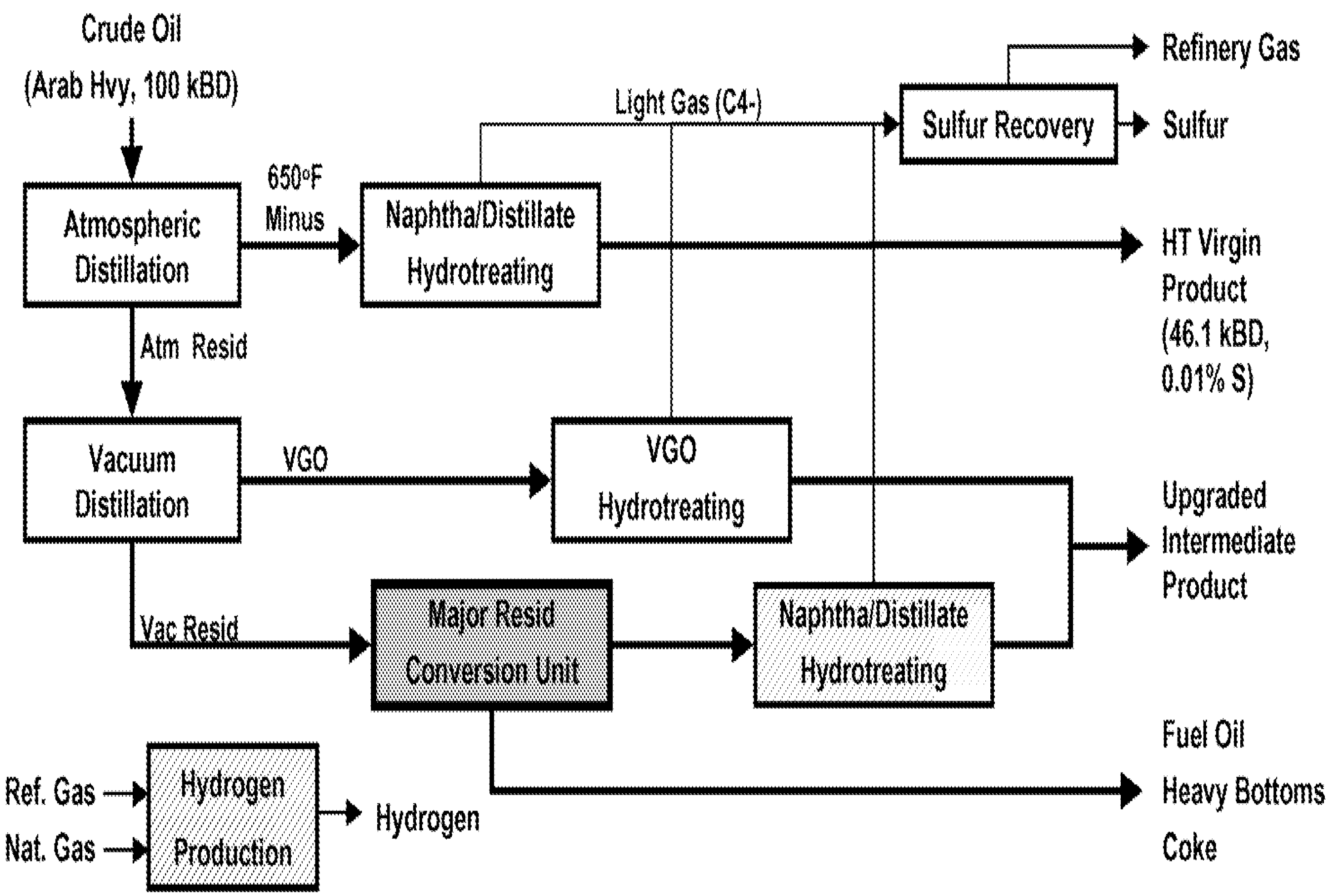
Economic Comparison of Hydroconversion and Thermal Conversion Technologies

- SFA Pacific Industry Study Provided Starting Point (1)
  - Comparison Made on a Consistent Resid Conversion Project Basis
  - Constant Crude Rate to Refinery
  - Resid Conversion and Virgin Products Upgraded to Consistent Intermediate Product Quality

- EMRE Calculated Minimum "Gross Margin" Needed to Recover Total Cost for Each Resid Conversion Option
  - Gross Margin = Product Revenues - Crude Cost
  - Total Cost = Fixed (15% ROI) and Operating Costs
  - Compared Results for Hydroconversion and Coking Options
  - Examined Impact of Natural Gas Price on Results

1) SFA PAcific, Inc, "Upgrading Heavy Crude Oils and Residues to Transportation Fuels, Phase 7", May 2003

Generalized Refinery Flowscheme - Conversion(1)

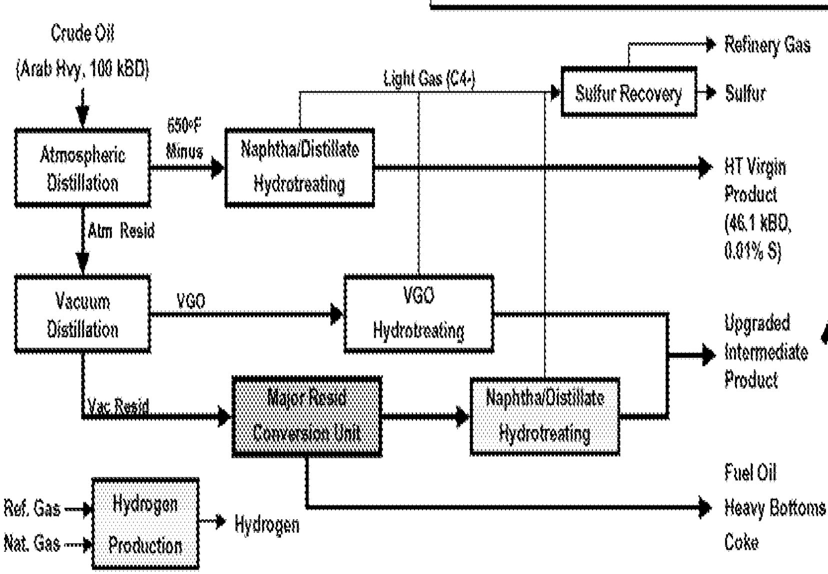


1) SFA PAcific, Inc, "Upgrading Heavy Crude Oils and Residues to Transportation Fuels, Phase 7", May 2003

Production of Upgraded Intermediate Products

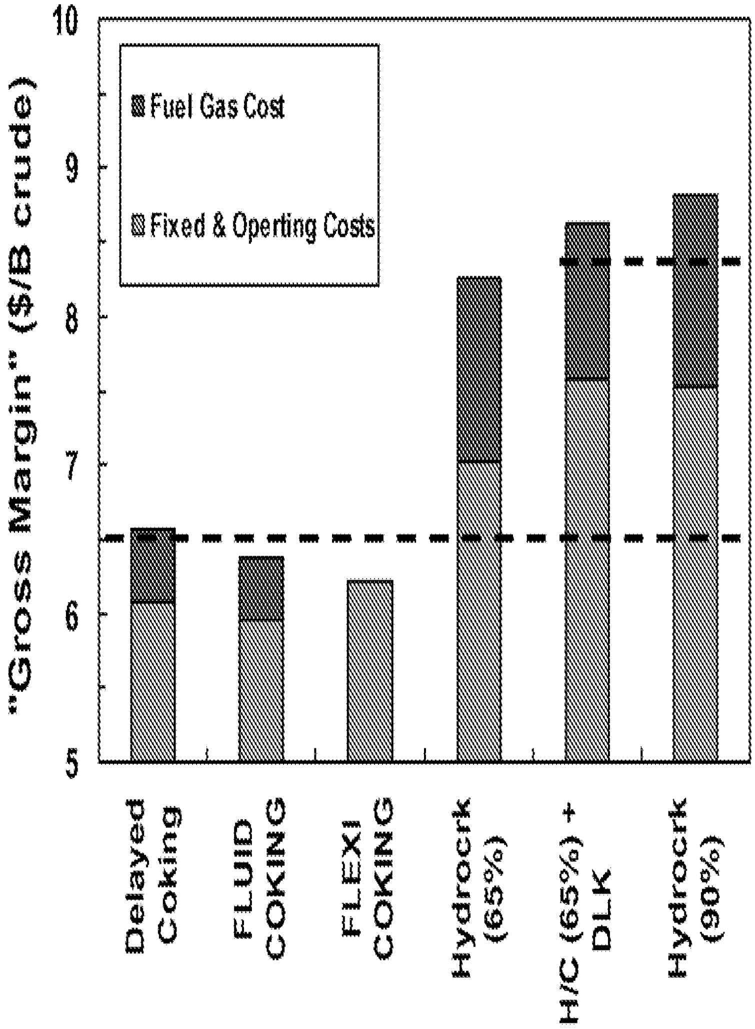
- FLUID COKING, Delayed Coking, Hydroconversion Similar
- Hydroconversion + Coking or High Conversion Hydro. Produce More but Capital Cost and Bottoms Disposal are Issues

Resid Technology	*Upg. Intermed. Prod.Rate(kBD)*	*Gravity (°API)*	*Sulfur (%)*
Delayed Coking	46.3	32.8	0.08
FLUID COKING	47.0	31.9	0.08
FLEXICOKING	47.0	31.9	0.08
Hydrocracking @ 65% Conv.	48.2	32.2	0.08
Hydrocracking @ 65% Conv. with coking of bottoms	50.3	32.2	0.08
Hydrocracking @ 90% Conv.	52.6	33.0	0.07



Coking Has Economic Advantage vs Hydroconversion

- Resid Conversion Attractive for "Gross Margin" > 7 $/bbl
- Coking Has ~ 2$/bbl Advantage over Hydroconversion Technologies
- Delayed Coking and FLUID COKING Require Similar Margin
- FLEXICOKING has an Advantage with Natural Gas at $3.50/MBtu

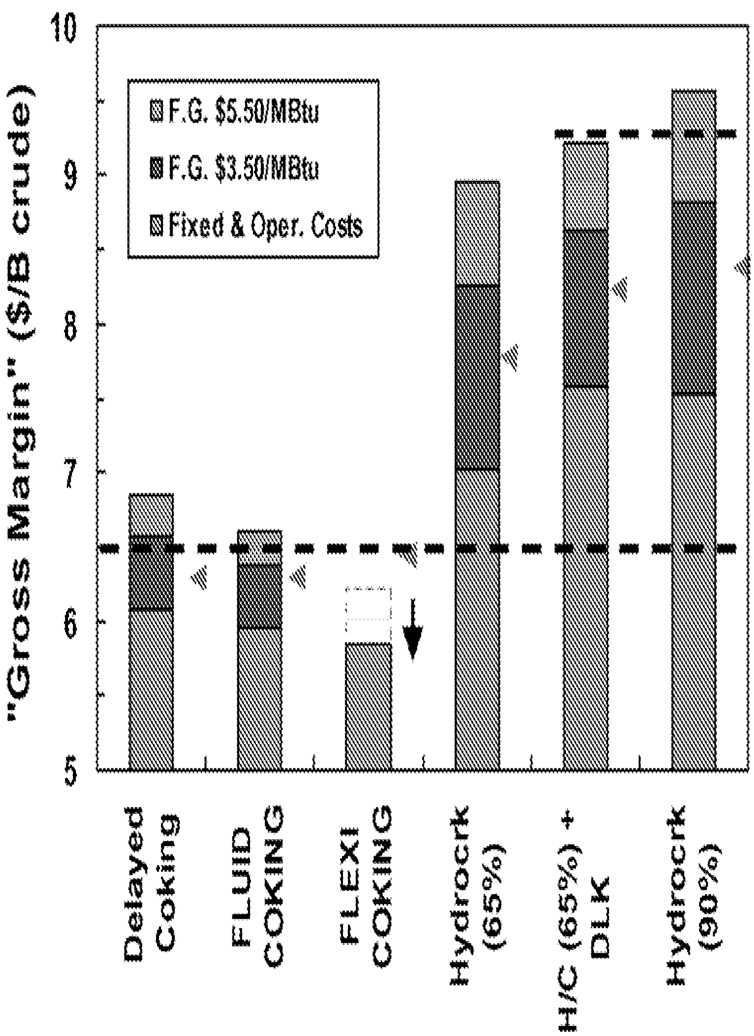


Basis

- Arabian Heavy Crude
- Gas at $3.50/MBtu
- Product slate to liquid intermediate products and solids/pitch
- Capital recovery at 15% ROI
- Screening class economic evaluation
- US Gulf Coast location
- Ref: SFA PACIFIC Phase 7

FLEXICOKING Has Significant Economic Advantage at High Gas Prices

- FLUID COKING Favored over Delayed Coking at Higher Gas Prices
- Coking Advantage vs Hydroconversion Increases with Gas Price(~3 $/bbl)



Basis

- Arabian Heavy Crude
- Gas at \$3.50/MBtu and \$5.50/MBtu
- Gas at \$2/MBtu indicated by arrows
- Product slate to liquid intermediate products and solids/pitch
- Capital recovery at 15% ROI
- Screening class economic evaluation
- US Gulf Coast location
- Ref: SFA PACIFIC Phase 7

Summary

- Growing Interest in Resid Conversion

- FLUID COKING is a Commercially Proven Technology and has Process Advantages over Delayed Coking
  - FLUID COKING can be efficiently integrated with a Fluid Bed Boiler for production of steam and electric power.

- FLEXICOKING is a Commercially Proven Technology That Produces Flexigas as Fuel Gas Substitute From Low Valued Coke
  - Flexigas can be burned in refinery or nearby plants.

- Economic Comparisons Show That Coking Generally Favored Over Hydroconversion
  - FLEXICOKING especially attractive at high natural gas prices